normal, or at least never so degenerate as the first two that were studied. He concludes as the result of his investigation up to this point: firstly, that in lower mammals and young human beings the collateral ganglia (if we may judge from the superior cervical and semilunar) are functionally active, but that in monkeys there are evidences of commencing loss of function, which has completely disappeared in the human adult; secondly, that in man the function of the lateral ganglia is maintained well into adult life and only begins to disappear in old age. It is a curious fact that in all these cases the sympathetic nerves are described as normal. The possibility of degenerate ganglia associated with normal nerves in the sympathetic system is not explained by any existing view of the relation between cells and fibers in that region and at first sight, at least, is one of the most striking results.

On the Minute Anatomy of the Vagus nerve in Selachians, with Remarks on the Segmental Value of the Cranial nerves. THOMAS W. SHORE. Journal of Anatomy and Physiology, Vol. XXIII, pp. 428—451. Plates XX—XXI.

In a former paper (noticed in this JOURNAL Vol. II, p. 309) the author gave a summary of our present knowledge of the anatomy and development of the vagus in Petromyzon, Elasmobranchs, Rana and Amniota. The present paper contains the results of the author's researches upon the microscopic anatomy of the vagus of the skate (*Raia batis* and *R. clav.*). The nerve cells of the vagus of the skate are arranged in five groups. The nerve does not contain any non-ganglionated somatic motor fibers, and there is only one small faciculus of ganglionated somatic sensory fibers, viz., the small dorsal branch. The splanchnic motor and probably splanchnic sensory fibers are well marked, and are, as in the case of a typical spinal nerve, divisible into a non-ganglionated portion, which runs chiefly in the post-branchial branches, and a small-fibred ganglionated part, which is found in the branchials and visceralis. The vagus nerve of the skate, therefore, does not contain all the elements of a single perfect spinal nerve-metamer. It contains the typical elements of the so called sympathetic system, namely, splanchnic small medullated fibers some of which join a proximal set of ganglia, others passing on to a distal set. The proximal set of ganglia are represented by the branchial and viceralis ganglia, the distal set by the pre-branchial ganglia of the skate's vagus. F. T.

A demonstration of centres of ideation in the brain from observation and experiment. BERNARD HOLLANDER. Reprinted from the Journal of the Anthropological Institute, (London,) August, 1889.

The author attempts to correlate the modern experiments of the brain physiologists with the older observations of the phrenologists. Some half dozen "organs" are thus identified with the "centres" on the general principle that the "organ" is located in the region, where stimulation of the cortex gives rise to movements, gestures or facial motions that are expressive of the feeling for which the organ stands. The method pursued in correlating the two is however unscientific. Judging by the "discussion" at the end of the paper it was nevertheless received without any severe criticism. A paper of the same import was read by the author before the Anthro-

pological Section of the British Association for the Advancement of Science.

Heat Centers in Man. ISAAC OTT, M. D. Brain, January, 1889.

From the study of the lower animals the author recognizes six centers, injury to which causes increased temperature. These are described as the cruciate, about the Rolandic fissure, the Sylvian at the junction of the supra and post-Sylvian fissures, the caudate nucleus, the tissues about the corpus striatum and the optic thalamus near the median line, and the anterior end of the optic thalamus itself. A few cases are presented which are considered to indicate the existence of similar heat centers in man, and in the closing sentence the task of localization with the required precision is said to devolve upon neuropathologists.

II.—EXPERIMENTAL.

COLORED SHADOWS.[1]

Whenever an object is illuminated from two different directions by lights which are approximately equal in intensity but more or less different in color, the shadows thrown by the object, especially if they fall on a white ground, will be colored. The difference in shade may be so slight that we ordinarily regard both lights as white, as in case of candle and moonlight, yet the colored shadows will appear. When the light from one source is white, its shadow is of the color of the other light; for it is illuminated by the latter light alone. But the other shadow, although it is illuminated only by white light, yet always appears of a color complementary to that of the neighboring field, which is illuminated by both lights together.

These shadows may be obtained in various ways, and they are of by no means infrequent occurrence. We see them in the theatre when colored lights are used, or in our room if we have a colored shade for our lamp. We notice them sometimes on the page we are reading, when the window shade is partly drawn, so that the daylight enters partly uncolored through the window, and partly slightly tinted through the shade. Goethe and others speak of beautiful effects caused by the setting sun shining on snow-covered fields. For experimental purposes the best plan is to use a dark room arranged in a manner soon to be described.

The color of the complementary shadow is at first sight hard to account for, and has given rise to much discussion. Helmholtz and others think that it is an effect of contrast with the neighboring field, due to a "deception of judgment," and that colored shadows form an *experimentum crucis*[2] of the psychological nature of color-contrast. There are certain facts connected with the shadows, they maintain, which entirely overthrow the physiological theories. We hope to show that in this they are wrong; that all the phenomena presented by these shadows can be explained at least equally as well —many of them, it seems, very much better—by a purely physiological theory.

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[1] Written for the Graduate Course in Psychology at Harvard University.

[2] Von Kries, "Gesichtsempfindungen," p. 131f